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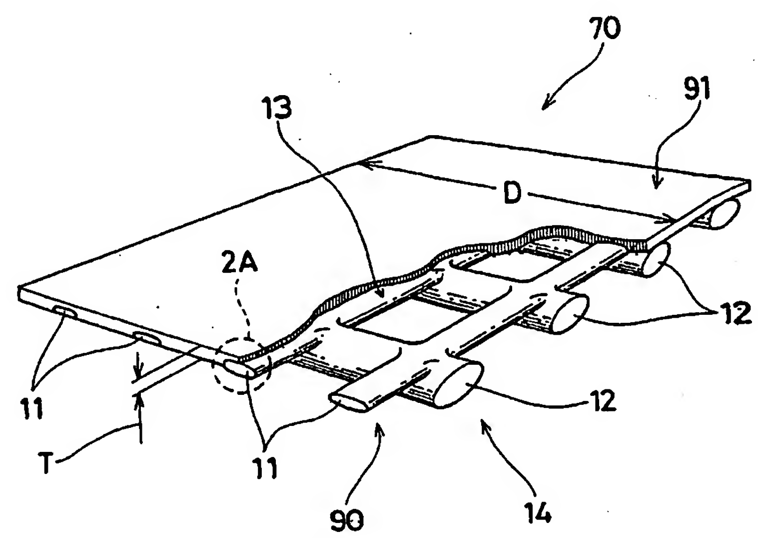
(54) Title: ELASTIC LAMINATE INCLUDING ELASTOMERIC SCRIM AND FIBROUS LAYER BONDED THERETO AND METHOD FOR MAKING THE SAME



(57) Abstract: The present invention is directed to an elastic laminate (70) elastically extensible in at least one direction. The elastic laminate (70) includes a first fibrous layer (91) including first component fibers; and an elastomeric scrim (90) including a plurality of first strands (11) and a plurality of second strands (12) which intersect the first strands (11). The first component fibers of the first fibrous layer (91) are melted to form a fusion bond between the first fibrous layer (91) and the elastomeric scrim (90), while the elastomeric scrim (90) keeps an integrity of the first and second strands (11, 12). The present invention is also directed to a method for forming an elastic laminate (70). The method includes the steps of: supplying a first fibrous layer (91) including first component fibers, the first component fibers having a first softening temperature at a first bonding pressure; applying a heat to the first fibrous layer (91) so that at least a portion of the first fibrous layer can have a temperature which is higher than the first softening temperature; supplying an elastomeric scrim (90) including a plurality of first strands (11) and a plurality of second strands (12) which intersect the first strands (11); juxtaposing the first fibrous layer (91) and the elastomeric scrim (90); and applying a pressure of at least the first bonding pressure to the juxtaposed portion of the first fibrous layer (91) and the elastomeric scrim (90) so that the first component fibers of the first fibrous layer (91) can be melted to form a fusion bond between the first fibrous layer (90) and the elastomeric scrim (90), while the elastomeric scrim (90) keeps an integrity of the first and second strands (11, 12).

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ELASTIC LAMINATE INCLUDING ELASTOMERIC SCRIM AND FIBROUS LAYER BONDED THERETO AND METHOD FOR MAKING THE SAME

FIELD

The present invention relates to elastic laminates. More specifically, the present invention relates to elastic laminates which include an elastomeric scrim and a fibrous layer bonded thereto. The present invention also relates to methods for making such elastic laminates. The present invention further relates to disposable products which incorporate such elastic laminates.

BACKGROUND

Elastic laminates have previously been used in a variety of disposable products such as sweat bands, bandages, body wraps, disposable underwears, disposable garments including disposable diapers (adult and baby) including pull-on diapers and training pants, disposable panties for menstrual use, and disposable absorbent pads including sanitary napkins and incontinence devices. Herein, "elastic laminate" refers to an elastically extensible two or more layered, at least partially, materials including at least one elastically extensible single layer material. It is generally expected that these products provide good fit to the body and/or skin of the user by using suitable elastic members during the entire use period of products.

Those elastic laminates typically include, at least, a fibrous layer (e.g., a nonwoven layer) and an elastomeric material joined to the fibrous layer. These materials are joined together typically through an adhesive (or glue) bond or a heat/pressure bond formed therebetween.

Elastomeric scrims are preferably used as such an elastomeric material since it can provide a good performance on breathability of products. The adhesive bond is often used for forming elastic laminates which include an elastomeric scrim. For example, International Publication No. WO 98/55298 (Langdon et al.) published on December 10,

1998 discloses an elastic laminate using an adhesive for forming a laminate structure. However, the use of adhesive tends to cause several problems in its manufacturing process(es) and its usage by consumers. For example, a manufacturing process which includes an adhesive application tends to become more complicated than that which does not need it (e.g., a heat/pressure bond process). In addition, the adhesive application tends to cause a contamination problem in manufacturing equipments or production lines because the use of adhesive. Further, an elastic laminate which uses an adhesive tends to cause an odor problem to consumers of disposable products, since some adhesive materials have a strong and/or uncomfortable smell. Further, an elastic laminate which uses an adhesive tends to make the laminate itself stiff and/or thick.

Consequently, it is generally believed that the use of the heat/pressure bond is preferred for forming elastic laminates since it does not have the above problems. For example, International Patent Publication No. WO 98/02300 published on January 22, 1998 discloses an elastic laminate which includes a fabric layer and an elastomeric mesh having strands integrally bonded to the fabric layer. The disclosed structure can provide a comfortable feel to the wearer, however, the strands of the mesh tend to be physically damaged by the process for forming such an integral bond between the mesh and the fabric layer. As a result, the strength or toughness of the mesh against a tear force externally applied thereto (i.e., the tear strength) is reduced seriously. This is because when the strands of the mesh are integrally bonded to the fabric layer, a melted material of the strands of the mesh penetrates into the fabric layer to form the integral bond. International Patent Publications No. WO 98/05491 published on February 12, 1998 and No. WO 99/10166 published on March 4, 1999 also disclose similar elastic laminates to that disclosed in WO 98/02300.

Based on the foregoing, there is a need for elastic laminates including an elastomeric scrim whose tear strength is less affected by a fibrous layer bonded thereto. There is also another need for disposable products that incorporate such elastic laminates.

SUMMARY

The present invention is directed to an elastic laminate elastically extensible in at least one direction. The elastic laminate includes a first fibrous layer including first component fibers; and an elastomeric scrim including a plurality of first strands and a

plurality of second strands which intersect the first strands. The first component fibers of the first fibrous layer are melted to form a fusion bond between the first fibrous layer and the elastomeric scrim, while the elastomeric scrim keeps an integrity of the first and second strands.

The present invention is also directed to a method for forming an elastic laminate. The method includes the steps of: supplying a first fibrous layer including first component fibers, the first component fibers having a first softening temperature at a first bonding pressure; applying a heat to the first fibrous layer so that at least a portion of the first fibrous layer can have a temperature which is higher than the first softening temperature; supplying an elastomeric scrim including a plurality of first strands and a plurality of second strands which intersect the first strands; juxtaposing the first fibrous layer and the elastomeric scrim; and applying a pressure of at least the first bonding pressure to the juxtaposed portion of the first fibrous layer and the elastomeric scrim so that the first component fibers of the first fibrous layer can be melted to form a fusion bond between the first fibrous layer and the elastomeric scrim, while the elastomeric scrim keeps an integrity of the first and second strands.

The present invention is further directed to a disposable product including such an elastic laminate.

The foregoing answers the need for elastic laminates including an elastomeric scrim whose tear strength is less affected by a fibrous layer bonded thereto. The foregoing also answers the need for disposable products that incorporate such elastic laminates.

These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from reading of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the invention will be better understood from the following description of preferred embodiments which is taken in conjunction with the accompanying drawings and which like designations are used to designate substantially identical elements, and in which:

Fig. 1 is an exploded view of the elastomeric scrim and first fibrous layer prior to being formed into a laminate structure in accordance with the present invention;

Fig. 2 is a partial perspective view of an elastic laminate in accordance with the present invention, wherein a portion of the fibrous layer has been removed to show the elastomeric scrim;

Fig. 2A is an enlarged partial perspective view of the elastic laminate shown in Fig. 2;

Fig. 3 is a schematic representation of a plate presser process according to the present invention for forming the elastic laminate of Fig. 2;

Fig. 4 is a schematic representation of a gapped nip process according to the present invention for forming the elastic laminate of Fig. 2;

Fig. 5 is a perspective view of one preferred embodiment of the disposable pull-on diaper according to the present invention in a typical in use configuration;

Fig. 6 is a simplified plan view of the embodiment shown in Fig. 5 in its flat uncontracted condition showing the body-facing side of the garment; and

Fig. 7 is a cross-sectional view of a preferred embodiment taken along the section line 7-7 of Fig. 6.

DETAILED DESCRIPTION

All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

Herein, "comprise" and "include" mean that other element(s) and step(s) which do not affect the end result can be added. These terms encompass the terms "consisting of" and "consisting essentially of".

Herein, "extensible" refers to materials that are capable of extending in at least one direction to a certain degree without undue rupture.

Herein, "elasticity" and "elastically extensible" refer to extensible materials that have the ability to return to approximately their original dimensions after the force that extended the material is removed. Any material or element described as "extensible" may also be elastically extensible unless otherwise provided.

Herein, "pull-on garment" refers to articles of wear which have a defined waist opening and a pair of leg openings and which are pulled onto the body of the wearer by inserting the legs into the leg openings and pulling the article up over the waist.

Herein, "disposable" describes garments which are not intended to be laundered or otherwise restored or reused as a garment (i.e., they are intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner).

Herein, "pull-on diaper" refers to pull-on garments generally worn by infants and other incontinent individuals to absorb and contain urine and feces. It should be understood, however, that the present invention is also applicable to other pull-on garments such as training pants, incontinent briefs, feminine hygiene garments or panties, and the like.

Herein, "nonwoven" may include any material which has been formed without the use of textile weaving processes which produce a structure of individual fibers which are interwoven in an identifiable manner. Methods of making suitable nonwovens includes a carded nonwoven process, a spunbonded nonwoven process, or the like.

Herein, "panel" denotes an area or element of the pull-on garment. While a panel is typically a distinct area or element, a panel may coincide (functionally correspond) somewhat with an adjacent panel.

Herein, "layer" does not necessarily limit the element to a single strata of material in that a layer may actually comprise laminates or combinations of sheets or webs of the requisite type of materials.

Herein, "fibrous layer" refers to a layer which include and is formed by component fibers. The component fibers can be either synthetic or natural. The fibrous layer can include woven materials, nonwoven materials, tissue materials, and the like.

Herein, "joined" or "joining" encompasses configurations whereby an element is directly secured to another by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element.

Herein, "uncontracted state" is used to describe states of pull-on garments in its unseamed (i.e., seams are removed), flat and relaxed condition wherein all elastic materials used are removed therefrom.

The elastic laminate of the present invention can be incorporated into a variety of products (not illustrated) wherein it is desired to provide at least one structural direction which is partially or entirely elastically extensible along its length. Examples of such

products include sweat bands, bandages, body wraps, disposable underwears, disposable garments including disposable diapers (adult and baby) including pull-on diapers and training pants, disposable panties for menstrual use, disposable absorbent pads including sanitary napkins and incontinence devices, and the like.

Fig. 1 is an exploded view of the components of an elastic laminate 70 prior to its formation (the elastic laminate 70 is shown in Fig. 2). As illustrated, the elastic laminate 70 includes (or is formed from) a first fibrous layer 91 including first component fibers (not shown in Fig. 1 but in Fig. 2A) and an elastomeric scrim 90 including a plurality of first strands 11 and a plurality of second strands 12 which intersect the first strands 11. The elastomeric scrim 90 has a first surface 13 and a second surface 14 opposed to the first surface 13. As shown in Fig. 1, the elastic laminate 70 has at least one structural direction D. The elastic laminate 70 is elastically extensible in at least the structural direction D. The elastic laminate 70 may also be elastically extensible in a structural direction B which is perpendicular to the structural direction D. Preferably, the elastic laminate 70 is elastically extensible along the direction D and the entire length of the second strands 12. Herein, "structural direction" (e.g., D) is intended to mean a direction which extends substantially along and parallel to the plane of the first and second surface 13 and 14 of the elastomeric scrim 90.

The first fibrous layer 91 is bonded to the first surface 13 of the elastomeric scrim 90 as shown in Fig. 2. Specifically, the first component fibers of the first fibrous layer 91 are melted to form a fusion bond between the first fibrous layer 91 and the elastomeric scrim 90 as shown in Fig. 2A, while the elastomeric scrim 90 keeps an integrity of the first and second strands 11 and 12.

The elastomeric scrim 90 includes the plurality of first strands 11 which intersect or cross (with or without bonding to) the plurality of second strands 12 at nodes 15 at a predetermined angle α, thereby forming a net-like open structure having a plurality of apertures 16. Each aperture 16 is defined by at least two adjacent first strands 11 and at least two adjacent second strands 12 such that apertures 16 are substantially rectangular (preferably square) in shape. Other aperture configurations, such as parallelograms or circular arc segments, can also be provided. Such configurations could be useful for providing non-linear elastic structural directions. It is preferred that first strands 11 are

substantially straight and substantially parallel to one another, and more preferably, that second strands 12 are also substantially straight and substantially parallel to one another. Most preferably, the first strands 11 intersect second strands 12 at nodes 15 at a predetermined angle α of about 90 degrees. Each node 15 is an overlaid node, wherein first strands 11 and second strands 12 are preferably joined or bonded (although it is contemplated that joining or bonding may not be required) at the point of intersection with the strands still individually distinguishable at the node 15. However, it is believed that other node configurations such as merged or a combination of merged and overlaid would be equally suitable.

Although it is preferred that first and second strands be substantially straight, parallel, and intersect at an angle α of about 90 degrees, it is noted that the first and second strands 11 and 12 can intersect at other angles α, and that the first strands 11 and/or the second strands 12 can be aligned in circular, elliptical or otherwise nonlinear patterns relative to one another. Although for ease of manufacture it is contemplated that the first strands 11 and the second strands 12 have a substantially circular cross-sectional shape prior to incorporation into the elastic laminate 70 (as shown in Fig. 1), the first and second strands 11 and 12 can also have other cross-sectional shapes such as elliptical, square, triangular or combinations thereof.

Preferred materials for forming the first and second strands 11 and 12 of the elastomeric scrim 90 include polyolefins, polyamides, polyesters, and rubbers (e.g., styrene butadiene rubber, polybutadiene rubber, polychloroprene rubber, nitrile rubber and the like). A preferred elastomeric scrim is a styrene block copolymer based scrim, preferably with a thickness of from about 0.3 mm to about 1.2 mm. Additionally, an adjunct materials can be added to the base materials comprising for the first and second strands 11 and 12 (e.g., mixtures of pigments, dyes, brighteners, heavy waxes and the like) to provide other desirable visual, structural or functional characteristics. The elastomeric scrim 90 can be formed from one of a variety of processes known in the art.

Preferably, the first and second strands 11 and 12 of the elastomeric scrim 90 are formed by an identical material. However, the first and second strands 11 and 12 can be formed by different materials.

A preferred elastomeric scrim is available from the Conwed Plastics Company (Minneapolis, Minn., U.S.A.) under the designation XO2514. This material has about 12 elastic strands per inch in the structural direction B (i.e., the first strands 11) and about 7 elastic strands per inch in the structural direction D (i.e., the second strands 12).

The first fibrous layer 91 includes first component fibers 17 (not shown in Fig. 1 but Fig. 2A). The first fibrous layer 91 can include any types of component fibers as long as they are melted to form a fusion bond between the first fibrous layer 91 and the elastomeric scrim 90, while the elastomeric scrim 90 keeps an integrity of the first and second strands 11 and 12. To keep the integrity of the first and second strands 11 and 12, the fusion bond is formed by primarily a partially melted material 18 of the component fibers 17 as shown in Fig. 2A. Herein, "primarily" means that at least about 60%, more preferably at least about 80%, and yet more preferably at least about 90% by weight of the material that forms the fusion bond is occupied by the melted material 18 of the first fibrous layer 91 (i.e., the component fibers 17). Since the elastomeric scrim 90 can be less damaged by the process for forming the fusion bond, the tear strength of the elastomeric scrim 90 is less affected by the fibrous layer 91.

Herein, "tear strength" of a material generally means a physical strength or toughness of the material against a tear force which is externally applied to the material. For example, the tear strength of a sample elastomeric scrim can be measured by continuously applying a tear force which causes about 100% extension of the sample elastomeric scrim which has a predetermined width and length. The sample elastomeric scrim is kept in a predetermined temperature (e.g., 37^{o}C). The tear strength is defined as the time period between the time when the tear force is first applied to the sample and the time when at least 30% of the sample in width is torn. In this exemplified method, the longer time period shows the greater tear strength of the sample elastomeric scrim.

A preferred material for the component fibers of the first fibrous layer 91 is selected from the group consisting of polyolefine, polyester, polyamide, and mixtures thereof. These component fibers can be joined together by adhesives, thermal bonding, needling/felting, or other methods known in the art to form the first fibrous layer 91.

Preferably, the first fibrous layer 91 has a basis weight of from about 15 gm/m^2 to about 100 gm/m^2, more preferably from about 25 gm/m^2 to about 80 gm/m^2. For ease of

manufacture and cost efficiency, a preferred material for the first fibrous layer 91 is a nonwoven material, more preferably a spunbonded nonwoven material formed by bi-component fibers of polyethylene (sheath) and polypropylene (core).

A preferred spunbonded nonwoven material is available from Fiberweb Company, (U.S.A.) under the designation of Sofspan. This material has a basis weight of about 25 g/m^2 before consolidation and a basis weight of about 63 g/m^2 after consolidation.

Preferably, at least about 5%, more preferably from about 15% to about 90%, and yet more preferably from about 20% to about 60% in the thickness T of the first fibrous layer 91 are melt or fused to form a fusion bond in the elastic laminate. A preferred fusion bond can be achieved by appropriately selecting the materials employed for the component fibers of the first fibrous layer 91 and the elastomeric scrim 90. In particular, the softening temperatures of such materials at an applied pressure need to be carefully considered. Herein, "softening temperature" is intended to mean the temperature at which a material flows or deforms under an applied pressure. Typically, heat is applied to a material to achieve a softening temperature. This generally results in a decrease in the viscosity of the material which may or may not involve a "melting" of the material. Thermoplastic materials tend to exhibit a lowering in viscosity as a result of an increase in temperature allowing them to flow when subjected to an applied pressure. It will be understood that as the applied pressure increases, the softening temperature of a material decreases and therefore a given material can have a plurality of softening temperatures because the temperature will vary with the applied pressure.

Preferably, the first fibrous layer 91 inherently has a desired modulus so that the elastic laminate 70 can be extended in a structural direction with a minimal force. However, if the first fibrous layer 91 does not inherently have a desired modulus, the first fibrous layer 91 need to be subjected to an activation process before or after forming the elastic laminate 70. As taught for instance in U.S. Patent No. 4,834,741 issued to Sabee on May 30, 1989, subjecting the first fibrous layer 91 to an activation process (either separately or as part of the elastic laminate 70) will plastically deform the first fibrous layer 91 such that it will provide the desired modulus. In an activation process, such as that taught by Sabee, the first fibrous layer 91 (or laminate structure incorporating same) is passed between corrugated rolls to impart extensibility thereto by laterally stretching the first fibrous layer 91 in the

cross-machine direction. The first fibrous layer 91 is incrementally stretched and drawn to impart a permanent elongation in the cross-machine direction. This process can be used to stretch the first fibrous layer 91 before or after the fusion bond is formed between the first fibrous layer 91 and the elastomeric scrim 90. This process can provide a preferred elastic laminate 70 which can be extended in a structural direction with a minimal force. A similar activation process to Sabee is also disclosed in U.S. Patent No. 5,167,897 issued to Weber et al. on December 1, 1992; U.S. Patent No. 5,156,793 issued to Buell et al. on October 20, 1990; and U.S. Patent No. 5,143,679 issued to Weber et al. on September 1, 1992.

The elastic laminate 70 may further includes a second fibrous layer (not shown in Figs.) including second component fibers. Such a second fibrous layer is joined to the second surface 14 of the elastomeric scrim 90. The second fibrous layer is preferably boded to the second surface 14 of the elastomeric scrim 90 in a bonding manner which is preferably similar to that for the first fibrous layer 91, i.e., the second component fibers of the second fibrous layer are melted to form a fusion bond between the second fibrous layer and the elastomeric scrim 90, while the elastomeric scrim 90 keeps an integrity of the first and second strands. The second fibrous layer may be joined to the second surface 14 of the elastomeric scrim 90 through adhesive. The second fibrous layer can be formed by any material(s) which is described above for the first fibrous layer 91.

In a preferred embodiment, the elastic laminate has a peel strength of at least about 30 gf/in. (about 11.8 gf/cm), more preferably at least about 50 gf/in. (about 19.7 gf/cm), and yet more preferably at least about 70 gf/in. (about 27.6 gf/cm). The peel strength is a measure for the bonding strength of two materials which are bonded together. Herein "peel strength" refers to the amount of load force required to separate two bonded materials from each other. In general, higher peel strength shows less chance of a separation of the two materials. A method for measuring the peel strength of the elastic laminate is explained in detail in the Test Method Section.

In a preferred embodiment of the present invention, an elastic laminate can be formed by a plate presser process shown in Fig. 3. Referring to Fig. 3, the plate process include an upper plate 148 having a first surface 151, and a lower plate 150 having a second surface 152. Preferably, both of the first and second surfaces 151 are formed by a substantially non-resilient material which has a good heat conductivity such as a steel

material. However, the first surface 151 can be formed by a substantially resilient material (e.g., a silicone or other deformable rubber), while the second surface 152 is formed by a substantially non-resilient material. A first fibrous layer 191 which will form the first fibrous layer 91 in the resulting laminate 70 is juxtaposed with an elastomeric scrim 190 which will form the elastomeric scrim 90 in the resulting laminate 70. The the juxtaposed materials are supplied to the process such that the first fibrous layer 191 is immediately adjacent the first surface 151.

The first surface 151 is heated to a temperature T1 by a first heating means (not shown in Figs.), while the second surface 152 is heated to a temperature T2 by a second heating means (not shown in Figs.). The temperature T1 is higher than the temperature T2. A bonding pressure P_b is applied to the juxtaposed fibrous layer 191 and the elastomeric scrim 190 by moving the first surface 151 of the first plate 148 toward the second plate surface 152 of the second plate 150 appropriately. The material of the first fibrous layer 191 (i.e., the component fibers) is heated up by the first surface 151 to its softening temperature at the applied bonding pressure P_b. Consequently, the material of the first fibrous layer 191 is softened or melt to form a fusion bond between the first fibrous layer 191 and the elastomeric scrim 190, while the elastomeric scrim 190 keeps an integrity of the first and second strands as already discussed. Thus, the application of the bonding pressure P_b bonds the first fibrous layer 191 to the elastomeric scrim 190. More preferably, the application of the bonding pressure P_b also deforms at least one, preferably both of the first and second strands 11 and 12 into a flattened shape (e.g., a substantially elliptical shape or a substantially flat shape). Preferably, the temperature T2 (the applied heat to the scrim 190) is enough to make the elastomeric scrim 190 be flattened. However, the temperature T2 needs to be within an appropriate range so that the elastomeric scrim 190 can retain an expected strength. Preferably, the first and second strands 11 and 12 have an average caliper reduction of at least about 5%, more preferably between about 10% to about 70%, and yet more preferably between about 20% to about 60%. The average caliper reduction CR is obtained by the following numerical formula (1):

$$CR = (Cb - Ca) / Cb \times 100 \ (\%) \qquad \text{---------} \qquad (1)$$

where Cb: the average caliper of the first and second strands 11 and 12 before the application of pressure P_b; and

Ca: the average caliper of the first and second strands 11 and 12 after the application of pressure P_b.

A preferred plate presser apparatus is available from Toyo Tester Industrial Co., Ltd., Osaka, Japan, under the trade name of TTK Heat Sealer.

In a preferred embodiment wherein the first fibrous layer 191 is the above described spunbonded nonwoven material available from Fiberweb Company, and wherein the elastomeric scrim 190 the above described scrim material available from the Conwed Plastics Company, the temperature T1 is in the range of from about 130 °C to about 150 °C. The temperature T2 is in the range of about 80 °C to about 110 °C. The bonding pressure P_b is in the range of from about 10 kgf/cm^2 to about 20 kgf/cm^2. The bonding pressure P_b is applied onto the juxtaposed first fabric layer 91 and the elastomeric scrim 190 for from about 8 seconds to about 15 seconds. The resulting elastic laminate has a peel strength of from about 20 gf/in. (about 7.9 gf/cm) to about 120 gf/in. (about 47.2 gf/cm).

In an alternative preferred embodiment of the present invention, an elastic laminate can be formed by a gapped nip process shown in Fig. 4. Referring to Fig. 4, the gapped nip process includes two gapped nip rollers 141 and 142. The roller 141 has a substantially resilient first surface 151. The roller 142 has a substantially non-resilient second surface 152. The first and second surfaces 151 and 152 are positioned in surface contact to one another thereby forming an interference gap 143. The gap 143 is determined so that the process can form a desired fusion bond between the first fibrous layer 191 and the elastomeric scrim 190, while the elastomeric scrim 190 keeps an integrity of the first and second strands. Preferably, both of the first and second surfaces 151 are formed by a substantially non-resilient material which has a good heat conductivity such as a steel material. However, the first surface 151 can be formed by a substantially resilient material (e.g., a silicone or other deformable rubber), while the second surface 152 is formed by a substantially non-resilient material. The first fibrous layer 191 is juxtaposed with the elastomeric scrim 190, and the juxtaposed materials are supplied to the process such that the first fibrous layer 191 is immediately adjacent the first surface 151 of the roller 141.

The first surface 151 is heated to a temperature T1 by a first heating means (not shown in Figs.), while the second surface 152 is heated to a temperature T2 by a second heating means (not shown in Figs.). The temperature T1 is higher than the temperature T2.

A bonding pressure P_b is applied to the juxtaposed fibrous layer 191 and the elastomeric scrim 190 through the gap 143. The material of the first fibrous layer 191 is heated up to its softening temperature at the applied bonding pressure P_b. The material of the first fibrous layer 191 is softened or melt to form a fusion bond between the first fibrous layer 191 and the elastomeric scrim 190, while the elastomeric scrim 190 keeps an integrity of the first and second strands. Thus, the application of the bonding pressure P_b bonds the first fibrous layer 191 to the elastomeric scrim 190. More preferably, the application of the bonding pressure P_b also deforms at least one, preferably both of the first and second strands 11 and 12 into a flattened shape (e.g., a substantially elliptical shape or a substantially flat shape). Preferably, the temperature T2 (the applied heat to the scrim 190) is enough to make the elastomeric scrim 190 be flattened. However, the temperature T2 needs to be within an appropriate range so that the elastomeric scrim 190 can retain an expected strength. Preferably, the first and second strands 11 and 12 have an average caliper reduction of at least about 5%, more preferably between about 10% to about 70%, and yet more preferably between about 20% to about 60%..

The feed rate of the juxtaposed first fibrous layer 191 and the elastomeric scrim 190 can be adjusted so that the first fibrous layer 191 has a sufficient residence time between the first and second surfaces 151 and 152 so that the first fibrous layer 191 and the elastomeric scrim 190 can be softened and deformed, respectively, as described herein. It has been found, however, that a smaller gapped nip 56 is required as this feed rate is increased to maintain the same relative pressure and hence deformation of the elastomeric scrim 190.

In a preferred embodiment wherein the first fibrous layer 191 is the above described spunbonded nonwoven material available from Fiberweb Company, and wherein the elastomeric scrim 190 is the above described scrim material available from the Conwed Plastics Company, the juxtaposed materials of the first fibrous layer 191 and the elastomeric scrim 190 are supplied to the process at a feed rate of from about 40 feet/min (about 12.2 m/min) to about 60 feet/min (about 18.3 m/min). The rollers 141 and 142 have a diameter of from about 40 cm to about 70 cm. The temperature T1 is in the range of from about 130 °C to about 160 °C. The temperature T2 is in the range of about 70 °C to about 110 °C. The bonding pressure P_b is in the range of about 20 kgf/cm^2 to about 50 kgf/cm^2. The

resulting elastic laminate has a peel strength of from about 20 gf/in. (about 7.9 gf/cm) to about 120 gf/in. (about 47.2 gf/cm).

The elastic laminate of the present invention can be incorporated into a variety of disposable products. Preferred disposable products include sweat bands, bandages, body wraps, disposable underwears, disposable garments including disposable diapers (adult and baby) including pull-on diapers and training pants, disposable panties for menstrual use, and disposable absorbent pads including sanitary napkins and incontinence devices. In a preferred embodiment, the present invention is applied to a disposable garment. In the following, a disposable pull-on diaper will be described in detail as one preferred embodiment of the present invention.

Fig. 5 shows one preferred embodiment of a disposable pull-on garment of the present invention (e.g., a unitary disposable pull-on diaper). Referring to Fig. 5, the disposable pull-on diaper 20 has a front region 26; a back region 28 and a crotch region 30 between the front region 26 and the back region 28. A chassis 41 is provided in the front, back and crotch regions 26, 28 and 30. The chassis 41 includes a liquid pervious topsheet 24, a liquid impervious backsheet 22 associated with the topsheet 24, and an absorbent core 25 (not shown in Fig. 5) disposed between the topsheet 24 and the backsheet 22.

The disposable pull-on diaper 20 further includes a pair of front ear panels 46 each extending laterally outward from the corresponding sides of the chassis 41 in the front region 26, and a pair of extensible back ear panels 48 each extending laterally outward from the corresponding sides of the chassis 41 in the back region 28. Each of the ear panels 46 and 48 has an outermost edge 240 which forms an outermost edge line 242. At least one of the outermost edge lines 242 has a nonuniform lateral distance LD from the longitudinal center line 100 (not shown in Fig. 5 but in Fig. 6) in the uncontracted state of the diaper 20. The pull-on diaper 20 further includes seams 32 each joining the front and back ear panels 46 and 48 along the corresponding edge lines 242 to form the two leg openings 34 and the waist opening 36.

In preferred embodiments, the pull-on diaper 20 includes a chassis layer 40 which generally determines the overall shape of the pull-on diaper 20. In the embodiment shown in Fig. 5, the chassis layer 40 is an outer cover nonwoven layer 74 which covers all of the outer-facing surface of the pull-on diaper 20 to provide the feel and appearance of a cloth

garment. The continuous sheet (i.e., the outer cover nonwoven layer 74) defines the front region 26, the back region 28 and the crotch region 30 between the front region 26 and the back region 28. Each of the ear panels 46 and 48 includes a portion of the chassis layer 40. Preferred pull-on diapers which includes such a continuous sheet are disclosed in U.S. Patent No. 5,569,234 issued to Buell et al. on October 29, 1996. In a preferred embodiment, the continuous sheet is formed by the nonwoven web which is available from Kuraray Co., Ltd., Osaka, Japan, under Code Nos. JP4128 and JP4144, and Vliesstoffwerk Christian Heinrich Sandler GmbH & Co. KG, Schwarzenbach/Scale, Germany, under Code Nos. VP22/98/61 and VP22/98/71.

In a preferred embodiment, at least one of, more preferably both of, the pairs of the ear panels 46 and 48 are elastically extensible in at least the lateral direction. In alternative embodiments, the ear panels 46 and 48 are elastically extensible both in the lateral and longitudinal directions. The extensible ear panels 46 and 48 provide a more comfortable and contouring fit by initially conformably fitting the pull-on diaper to the wearer and sustaining this fit throughout the time of wear well past when the pull-on diaper has been loaded with exudates since the ear panels 46 and/or 48 allow the sides of the pull-on diaper to expand and contract.

The ear panels 46 and 48 may be formed by unitary elements of the pull-on diaper 20 (i.e., they are not separately manipulative elements secured to the pull-on diaper 20, but rather are formed from and are extensions of one or more of the various layers of the pull-on diaper). In a preferred embodiment, the ear panels 46 and 48 include at least one unitary element or a continuous sheet (e.g. the chassis layer 40) that forms a part of the chassis 41 and continuously extends into the ear panels 46 and 48. Alternatively, the ear panels 46 and 48 may only include discrete members (not shown in Figs.) which do not have any unitary element that also forms a part of the chassis 41. Such an ear panel structure may be formed by joining the discrete members to the corresponding sides of the chassis 41.

In a preferred embodiment, the pull-on diaper 20 further includes seam panels 66 each extending laterally outward from each of the ear panels 46 and 48; and tear open tabs 31 each extending laterally outward from the seam panel 66. In a preferred embodiment, each of the seam panels 66 is an extension of the corresponding ear panels 46 and 48, or at least one of the component elements used therein (e.g., the chassis layer 40), or any other

combination of the elements. More preferably, each of the tear open tabs 31 is also an extension of the corresponding seam panel 66 or at least one of its component elements used therein (e.g., the chassis layer 40), or any other combination of its elements.

In a preferred embodiment, the corresponding edge portions of the ear panels 46 and 48 are joined through the seam panels 66 in an overlapping manner to make an overlapped seam structure as shown in Fig. 5. Alternatively, the front and ear panels 46 and 48 can be seamed in a butt seam manner (not shown in Figs.). The bonding of the seams 32 can be performed by any suitable means known in the art appropriate for the specific materials employed in the chassis 41 and/or the ear panels 46 and 48. Thus, sonic sealing, heat sealing, pressure bonding, adhesive or cohesive bonding, sewing, autogeneous bonding, and the like may be appropriate techniques. Preferably, the seam panels 66 are joined by a predetermined pattern of heat/pressure or ultrasonic welds which withstands the forces and stresses generated on the diaper 20 during wear.

A continuous belt 38 is formed by the ear panels 46 and 48, and a part of the chassis 41 about the waist opening 36 as shown in Fig. 5. Preferably, elasticized waist bands 50 are provided in both the front region 26 and the back region 28. The continuous belt 38 acts to dynamically create fitment forces in the pull-on diaper 20 when positioned on the wearer, to maintain the pull-on diaper 20 on the wearer even when loaded with body exudates thus keeping the absorbent core 25 (not shown in Fig. 5) in close proximity to the wearer, and to distribute the forces dynamically generated during wear about the waist thereby providing supplemental support for the absorbent core 25 without binding or bunching the absorbent core 25.

Fig. 6 is a partially cut-away plan view of the pull-on diaper 20 of Fig. 5 in its uncontracted state (except in the ear panels 46 and 48 which are left in their relaxed condition) with the topsheet 24 facing the viewer, prior to the ear panels 46 and 48 being joined together by the seams 32. The pull-on diaper 20 has the front region 26, the back region 28 opposed to the front region 26, the crotch region 30 positioned between the front region 26 and the back region 28, and a periphery which is defined by the outer perimeter or edges of the pull-on diaper 20 in which the side edges are designated 150 and 240, and the end edges or waist edges are designated 152. The topsheet 24 has the body-facing surface of the pull-on diaper 20 which is positioned adjacent to the wearer's body during use. The

backsheet 22 has the outer-facing surface of the pull-on diaper 20 which is positioned away from the wearer's body. The pull-on diaper 20 includes the chassis 41 including the liquid pervious topsheet 24, the liquid impervious backsheet 22 associated with the topsheet 24, and the absorbent core 25 positioned between the topsheet 24 and the backsheet 22. The diaper 20 further includes the front and back ear panels 46 and 48 extending laterally outward from the chassis 41, the elasticized leg cuffs 52, and the elasticized waistbands 50. The topsheet 24 and the backsheet 22 have length and width dimensions generally larger than those of the absorbent core 25. The topsheet 24 and the backsheet 22 extend beyond the edges of the absorbent core 25 to thereby form the side edges 150 and the waist edges 152 of the diaper 20. The liquid impervious backsheet 22 preferably includes a liquid impervious plastic film 68.

The pull-on diaper 20 also has two centerlines, a longitudinal centerline 100 and a transverse centerline 110. Herein, "longitudinal" refers to a line, axis, or direction in the plane of the pull-on diaper 20 that is generally aligned with (e.g. approximately parallel with) a vertical plane which bisects a standing wearer into left and right halves when the pull-on diaper 20 is worn. Herein, "transverse" and "lateral" are interchangeable and refer to a line, axis or direction which lies within the plane of the pull-on diaper that is generally perpendicular to the longitudinal direction (which divides the wearer into front and back body halves). The pull-on diaper 20 and component materials thereof also have a body-facing surface which faces the skin of wearer in use and an outer-facing surface which is the opposite surface to the body-facing surface.

While the topsheet 24, the backsheet 22, and the absorbent core 25 may be assembled in a variety of well known configurations, exemplary chassis configurations are described generally in U.S. Patent 3,860,003 entitled "Contractible Side Portions for Disposable Diaper" which issued to Kenneth B. Buell on January 14, 1975; and U.S. Patent 5,151,092 entitled "Absorbent Article With Dynamic Elastic Waist Feature Having A Predisposed Resilient Flexural Hinge" which issued to Kenneth B. Buell et al., on September 29, 1992.

Fig. 7 is a cross-sectional view of a preferred embodiment taken along the section line 7-7 of Fig. 6. The pull-on diaper 20 includes the chassis 41 including the liquid pervious topsheet 24, the liquid impervious backsheet 22 associated with the topsheet 24,

and the absorbent core 25 positioned between the topsheet 24 and the backsheet 22. The pull-on diaper 20 further includes the front ear panels 46 each extending laterally outward from the chassis 41, and an inner barrier cuffs 54. Although Fig. 7 depicts only the structure of the front ear panel 46 and the chassis 41 in the front region 26, preferably a similar structure is also provided in the back region 28. In a preferred embodiment, each of the front ear panels 46 is formed by a lamination of an extended part 72 of the barrier flap 56, an elastic laminate 70 and the outer cover nonwoven layer 74. The elastic laminate 70 is preferably formed by the elastic laminate of the present invention.

The absorbent core 25 can be any absorbent member which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining liquids such as urine and other certain body exudates. The absorbent core 25 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, hourglass, "T"-shaped, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in disposable pull-on garments and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent polymers; absorbent gelling materials; or any equivalent material or combinations of materials.

The configuration and construction of the absorbent core 25 may vary (e.g., the absorbent core 25 may have varying caliper zones, a hydrophilic gradient, a superabsorbent gradient, or lower average density and lower average basis weight acquisition zones; or may include one or more layers or structures). Further, the size and absorbent capacity of the absorbent core 25 may also be varied to accommodate wearers ranging from infants through adults. However, the total absorbent capacity of the absorbent core 25 should be compatible with the design loading and the intended use of the diaper 20.

A preferred embodiment of the diaper 20 has an asymmetric, modified hourglass-shaped absorbent core 25 having ears in the front and back waist regions 26 and 28. Other exemplary absorbent structures for use as the absorbent core 25 that have achieved wide acceptance and commercial success are described in U.S. Patent No. 4,610,678 entitled

"High-Density Absorbent Structures" issued to Weisman et al. on September 9, 1986; U.S. Patent No. 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to Weisman et al. on June 16, 1987; U.S. Patent No. 4,888,231 entitled "Absorbent Core Having A Dusting Layer" issued to Angstadt on December 19, 1989; and U.S. Patent No. 4,834,735, entitled "High Density Absorbent Members Having Lower Density and Lower Basis Weight Acquisition Zones", issued to Alemany et al. on May 30, 1989.

The chassis 41 may further include an acquisition/distribution core 84 of chemically stiffened fibers positioned over the absorbent core 25, thereby forming a dual core system. In a preferred embodiment, the fibers are hydrophilic chemically stiffened cellulosic fibers. Herein, "chemically stiffened fibers" means any fibers which have been stiffened by chemical means to increase stiffness of the fibers under both dry and aqueous conditions. Such means include the addition of chemical stiffening agents which, for example, coat and/or impregnate the fibers. Such means also include the stiffening of the fibers by altering the chemical structure of the fibers themselves, e.g., by cross-linking polymer chains.

The fibers utilized in the acquisition/distribution core 84 can also be stiffened by means of chemical reaction. For example, crosslinking agents can be applied to the fibers which, subsequent to application, are caused to chemically form intrafiber crosslink bonds. These crosslink bonds can increase stiffness of the fibers. Whereas the utilization of intrafiber crosslink bonds to chemically stiffen the fibers is preferred, it is not meant to exclude other types of reactions for chemical stiffening of the fibers.

In the more preferred stiffened fibers, chemical processing includes intrafiber crosslinking with crosslinking agents while such fibers are in a relatively dehydrated, defibrated (i.e. individualized), twisted, curled condition. Suitable chemical stiffening agents include monomeric crosslinking agents including, but not limited to, C_2-C_8 dialdehydes and C_2-C_8 monoaldehydes having an acid functionality can be employed to form the cosslinking solution. These compounds are capable of reacting with at least two hydroxyl groups in a single cellulose chain or on proximately located cellulose chains in a single fiber. Such crosslinking agents contemplated for use in preparing the stiffened cellulose fibers include, but are not limited to, glutaraldehyde, glyoxal, formaldehyde, and glyoxylic acid. Other suitable stiffening agents are polycarboxylates, such as citric acid.

The polycarboxylic stiffening agents and a process for making stiffened fibers from them are described in U.S. Patent No. 5,190,563, entitled "Process for Preparing Individualized, Polycarboxylic Acid crosslinked Fibers" issued to Herron, on March 2, 1993. The effect of crosslinking under these conditions is to form fibers which are stiffened and which tend to retain their twisted, curled configuration during use in the absorbent articles herein. Such fibers, and processes for making them are cited in the above incorporated patents.

Preferred dual core systems are disclosed in U.S. Patent No. 5,234,423, entitled "Absorbent Article With Elastic Waist Feature and Enhanced Absorbency" issued to Alemany et al., on August 10, 1993; and in U.S. Patent No. 5,147,345, entitled "High Efficiency Absorbent Articles For Incontinence Management" issued to Young, LaVon and Taylor on September 15, 1992. In a preferred embodiment, the acquisition/distribution core 84 includes chemically treated stiffened cellulosic fiber material, available from Weyerhaeuser Co. (U.S.A.) under the trade designation of "CMC". Preferably, the acquisition/distribution core 84 has a basis weight of from about 40 g/m^2 to about 400 g/m^2, more preferably from about 75 g/m^2 to about 300 g/m^2.

More preferably, the chassis 22 further includes an acquisition/distribution layer 82 between the topsheet 24 and the acquisition/distribution core 84 as shown in Fig. 7. The acquisition/distribution layer 82 is provided to help reduce the tendency for surface wetness of the topsheet 24. The acquisition/distribution layer 82 preferably includes carded, resin bonded hiloft nonwoven materials such as, for example, available as Code No. FT-6860 from Polymer Group, Inc., North America (Landisiville, New Jersey, U.S.A.), which is made of polyethylene telephthalate fibers of 6 dtex, and has a basis weight of about 43 g/m^2. A preferable example for the acquisition/distribution layer 82 and the acquisition/distribution core 84 is disclosed in EP 0797968A1 (Kurt et al.) published on October 1, 1997.

The topsheet 24 is preferably compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet 24 is liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet 24 may be manufactured from a wide range of materials such as woven and nonwoven materials; polymeric materials such as apertured formed thermoplastic films, apertured plastic films, and hydroformed thermoplastic films; porous foams; reticulated foams; reticulated thermoplastic films; and

thermoplastic scrims. Suitable woven and nonwoven materials can be included of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polymeric fibers such as polyester, polypropylene, or polyethylene fibers) or from a combination of natural and synthetic fibers. The topsheet 24 is preferably made of a hydrophobic material to isolate the wearer's skin from liquids which have passed through the topsheet 24 and are contained in the absorbent core 25 (i.e., to prevent rewet). If the topsheet 24 is made of a hydrophobic material, at least the upper surface of the topsheet 24 is treated to be hydrophilic so that liquids will transfer through the topsheet more rapidly. This diminishes the likelihood that body exudates will flow off the topsheet 24 rather than being drawn through the topsheet 24 and being absorbed by the absorbent core 25. The topsheet 24 can be rendered hydrophilic by treating it with a hydrophilic finishing oil or a surfactant. Suitable methods for the treatment for the topsheet 24 include spraying the topsheet 24 material with the surfactant and immersing the material into the surfactant. A more detailed discussion of such a treatment and hydrophilicity is contained in U.S. Patent No. 4,988,344 entitled “Absorbent Articles with Multiple Layer Absorbent Layers” issued to Reising, et al. on January 29, 1991 and U.S. Patent No. 4,988,345 entitled “Absorbent Articles with Rapid Acquiring Absorbent Cores” issued to Reising on January 29, 1991. Alternatively, the topsheet 24 may be a carded nonwoven material which is formed by hydrophilic component fibers.

In a preferred embodiment, the topsheet 24 is a nonwoven web that can provide reduced tendency for surface wetness; and consequently facilitate maintaining urine absorbed by the core 25 away from the user's skin, after wetting. One of the preferred topsheet materials is a thermobonded carded web which is available as Code No. P-8 from Fiberweb North America, Inc. (Simpsonville, South Carolina, U.S.A.). Another preferred topsheet material is available as Code No. S-2355 from Havix Co., Japan. This material is a bi-layer composite material, and made of two kinds of synthetic surfactant treated bi-component fibers by using carding and air-through technologies. Yet another preferred topsheet material is a thermobonded carded web which is available as Code No. Profleece Style 040018007 from Amoco Fabrics, Inc. (Gronau, Germany).

Another preferred topsheet 24 includes an apertured formed film. Apertured formed films are preferred for the topsheet 24 because they are pervious to body exudates and yet non-absorbent and have a reduced tendency to allow liquids to pass back through and rewet

the wearer's skin. Thus, the surface of the formed film which is in contact with the body remains dry, thereby reducing body soiling and creating a more comfortable feel for the wearer. Suitable formed films are described in U.S. Patent No. 3,929,135, entitled "Absorptive Structures Having Tapered Capillaries", issued to Thompson on December 30, 1975; U.S. Patent No. 4,324,246 entitled "Disposable Absorbent Article Having A Stain Resistant Topsheet", issued to Mullane, et al. on April 13, 1982; U.S. Patent No. 4,342,314 entitled "Resilient Plastic Web Exhibiting Fiber-Like Properties", issued to Radel. et al. on August 3, 1982; U.S. Patent No. 4,463,045 entitled "Macroscopically Expanded Three-Dimensional Plastic Web Exhibiting Non-Glossy Visible Surface and Cloth-Like Tactile Impression", issued to Ahr et al. on July 31, 1984; and U.S. 5,006,394 "Multilayer Polymeric Film" issued to Baird on April 9, 1991.

In a preferred embodiment, the backsheet 22 includes the liquid impervious film 68. Preferably, the liquid impervious film 68 longitudinally extends in the front, back and crotch regions 26, 28 and 30 as shown in Fig. 6. More preferably, the liquid impervious film 68 does not laterally extend into the at least one of the ear panels 46 or 48. Referring again to Fig. 7, the liquid impervious film 68 has a body-facing surface 79 and an outer-facing surface 77 opposing the body-facing surface 79. The liquid impervious film 68 is impervious to liquids (e.g., urine) and is preferably manufactured from a thin plastic film. However, more preferably the plastic film permits vapors to escape from the diaper 20. In a preferred embodiment, a microporous polyethylene film is used for the liquid impervious film 68. A suitable microporous polyethylene film is manufactured by Mitsui Toatsu Chemicals, Inc., Nagoya, Japan and marketed in the trade as PG-P. In a preferred embodiment, a disposable tape (not shown in Figs.) is additionally joined to the outer surface of the backsheet 22 to provide a convenient disposal after soiling. A preferred disposal tape (or device) for pull-on garments is disclosed in International Publication No. WO 94/09736 (Rollag et al.) published on May 11, 1994.

A suitable material for the liquid impervious film 68 is a thermoplastic film having a basis weight of from about 10 g/m^2 to about 45 g/m^2. Preferably, the thermoplastic film has a basis weight of from about 25 g/m^2 to about 40 g/m^2. In a preferred embodiment, the thermoplastic film has a basis weight of about 35 g/m^2.

The backsheet 22 further includes the outer cover nonwoven layer 74 (i.e., the chassis layer 40) which is joined with the outer-facing surface 77 of the liquid impervious film 68 to form a laminate. The outer cover nonwoven layer 74 preferably covers all of the outer-facing surface of the pull-on diaper 20 to provide the feel and appearance of a cloth garment. The outer cover nonwoven layer 74 may be joined to the liquid impervious film 68 by any suitable attachment means known in the art. For example, the outer cover nonwoven layer 74 may be secured to the liquid impervious film 68 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Suitable adhesives include a hotmelt adhesive obtainable from Nitta Findley Co., Ltd., Osaka, Japan as H-2128, and a hotmelt adhesive obtainable from H.B. Fuller Japan Co., Ltd., Osaka, Japan as JM-6064.

In a preferred embodiment, the outer cover nonwoven layer 74 is formed by the nonwoven web which is available from Kuraray Co., Ltd., Osaka, Japan, under Code Nos. JP4128 and JP4144, and Vliesstoffwerk Christian Heinrich Sandler GmbH & Co. KG, Schwarzenbach/Scale, Germany, under Code Nos. VP22/98/61 and VP22/98/71.

The backsheet 22 is positioned adjacent the outer-facing surface of the absorbent core 25 and is preferably joined thereto by any suitable attachment means known in the art. Specifically, the body-facing surface 79 of the liquid impervious film 68 may be secured to the absorbent core 25 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by H. B. Fuller Company of St. Paul, Minnesota, U.S.A., and marketed as HL-1358J. An example of a suitable attachment means including an open pattern network of filaments of adhesive is disclosed in U.S. Patent No. 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola et al. on March 4, 1986. Another suitable attachment means including several lines of adhesive filaments swirled into a spiral pattern is illustrated by the apparatus and methods shown in U.S. Patent No. 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent No. 4,785,996 issued to Ziecker, et al. on November 22, 1978; and U.S. Patent No. 4,842,666 issued to Werenicz on June 27, 1989. Alternatively, the attachment means may include heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any

other suitable attachment means or combinations of these attachment means as are known in the art.

In an alternative embodiment, the absorbent core 25 is not joined to the backsheet 22, and/or the topsheet 24 in order to provide greater extensibility in the front region 26 and the back region 28.

The pull-on diaper 20 preferably further includes elasticized leg cuffs 52 for providing improved containment of liquids and other body exudates. The elasticized leg cuffs 52 may include several different embodiments for reducing the leakage of body exudates in the leg regions. (The leg cuffs can be and are sometimes also referred to as leg bands, side flaps, barrier cuffs, elastic cuffs or gasketing cuffs.) U.S. Patent 3,860,003 entitled "Contractable Side Portions for Disposable Diaper" issued to Buell on January 14, 1975, describes a disposable diaper which provides a contractible leg opening having a side flap and one or more elastic members to provide an elasticized leg cuff. U.S. Patent 4,909,803 entitled "Disposable Absorbent Article Having Elasticized Flaps" issued to Aziz et al. on March 20, 1990, describes a disposable diaper having "stand-up" elasticized flaps (barrier cuffs) to improve the containment of the leg regions. U.S. Patent 4,695,278 entitled "Absorbent Article Having Dual Cuffs" issued to Lawson on September 22, 1987; and U.S. Patent 4,795,454 entitled "Absorbent Article Having Leakage-Resistant Dual Cuffs" issued to Dragoo on January 3, 1989, describe disposable diapers having dual cuffs including a gasketing cuff and a barrier cuff. U.S. Patent 4,704,115 entitled "Disposable Waist Containment Garment" issued to Buell on November 3, 1987, discloses a disposable diaper or incontinence garment having side-edge-leakage-guard gutters configured to contain free liquids within the garment.

While each elasticized leg cuff 52 may be configured so as to be similar to any of the leg bands, side flaps, barrier cuffs, or elastic cuffs described above, it is preferred that the elasticized leg cuff 52 includes an elastic gasketing cuff 62 with one or more elastic strands 64 as shown in Fig. 6, which is described in the above-referred U.S. Patent Nos. 4,695,278 and 4,795,454. It is also preferred that each elasticized leg cuff 52 further includes inner barrier cuffs 54 each including a barrier flap 56 and a spacing means 58 which are described in the above-referenced U.S. Patent No. 4,909,803.

The pull-on diaper 20 preferably further includes an elasticized waistband 50 that provides improved fit and containment. The elasticized waistband 50 is that portion or zone of the pull-on diaper 20 which is intended to elastically expand and contract to dynamically fit the wearer's waist. The elasticized waistband 50 preferably extends longitudinally outwardly from the waist edge of the pull-on diaper 20 toward the waist edge of the absorbent core 25. Preferably, the pull-on diaper 20 has two elasticized waistbands 50, one positioned in the back region 28 and one positioned in the front region 26, although other pull-on garment embodiments can be constructed with a single elasticized waistband. The elasticized waistband 50 may be constructed in a number of different configurations including those described in U.S. Patent 4,515,595 entitled "Disposable Diapers with Elastically Contractible Waistbands" issued to Kievit et al. on May 7, 1985 and the above referenced U.S. Patent 5,151,092 issued to Buell. In a preferred embodiment, the elasticized waistband 50 includes the elastic laminate of the present invention.

Preferably, each of the ear panels 46 and 48 includes the elastic laminate 70 of the present invention as shown in Fig. 7. The elastic laminate 70 is operatively joined to the outer cover nonwoven layer 74 and preferably the nonwoven webs 72 in the ear panels 46 and 48 to form a laminate. In a preferred embodiment, the elastic laminate 70 is operatively joined to the nonwoven webs 72 and 74 by securing them to at least one, preferably both of the nonwoven webs 72 and 74 while in a substantially untensioned (zero strain) condition.

The elastic laminate 70 can be operatively joined to the nonwoven webs 72 and 74, by using either an intermittent bonding configuration or a substantially continuous bonding configuration. Herein, "intermittently" bonded laminate web means a laminate web wherein the plies are initially bonded to one another at discrete spaced apart points or a laminate web wherein the plies are substantially unbonded to one another at discrete spaced apart areas. Conversely, a "substantially continuously" bonded laminate web means a laminate web wherein the plies are initially bonded substantially continuously to one another throughout the areas of interface. It is preferred that the stretch laminate be bonded over all or a significant portion of the stretch laminate so that the inelastic webs (i.e., the nonwoven webs 72 and 74) elongate or draw without causing rupture, and the layers of the stretch laminates are preferably bonded in a configuration that maintains all of the layers of the stretch laminate in relatively close adherence to one another after the incremental mechanical

stretching operation. Consequently, the elastic panel members and the other plies of the stretch laminate are preferably substantially continuously bonded together using an adhesive. In a preferred embodiment, the adhesive selected is applied with a control coat spray pattern at a basis weight of about 7.0 g/m^2. The adhesive pattern width is about 6.0 cm. The adhesive is preferably an adhesive such as is available from Nitta Findley Co., Ltd., Osaka, Japan, under the designation H2085F. Alternatively, the elastic panel member and any other components of the stretch laminates may be intermittently or continuously bonded to one another using heat bonding, pressure bonding, ultrasonic bonding, dynamic mechanical bonding, or any other method as is known in the art.

After the elastic laminate 70 is operatively joined to the nonwoven webs 72 and 74, at least a portion of the resultant composite stretch laminate is then subjected to mechanical stretching sufficient to permanently elongate the non-elastic components which are, for example, the nonwoven webs 72 and 74. The composite stretch laminate is then allowed to return to its substantially untensioned condition. At least one pair of, preferably both of the ear panels 46 and 48 is thus formed into “zero strain” stretch laminates. This configuration allows the ear panels 46 and 48 to be elastically extensible in at least the lateral direction.

A “zero strain” stretch laminate is one type of elastic laminate which is preferably used for such disposable products. For example, methods for making “zero strain” stretch laminate webs are disclosed in U.S. Patent No. 5,167,897 issued to Weber et al. on December 1, 1992; U.S. Patent No. 5,156,793 issued to Buell et al. on October 20, 1990; and U.S. Patent No. 5,143,679 issued to Weber et al. on September 1, 1992. In a manufacturing process for such “zero strain” stretch laminate, an elastomeric material is operatively joined to at least one non-elastic component material in a substantially untensioned (zero strain) condition. At least a portion of the resultant non-elastic composite stretch laminate is then subjected to mechanical stretching sufficient to permanently elongate the non-elastic component material. The composite stretch laminate is then allowed to return to its substantially untensioned condition. Thus, the elastic laminate is formed into a “zero strain” stretch laminate. Herein, “zero strain” stretch laminate refers to a laminate comprised of at least two plies of material which are secured to one another along at least a portion of their coextensive surfaces while in a substantially untensioned ("zero strain") condition; one of the plies comprising a material which is stretchable and

elastomeric (i.e., will return substantially to its untensioned dimensions after an applied tensile force has been released) and a second ply which is elongatable (but not necessarily elastomeric) so that upon stretching the second ply will be, at least to a degree, permanently elongated so that upon release of the applied tensile forces, it will not fully return to its original undeformed configuration. The resulting stretch laminate is thereby rendered elastically extensible, at least up to the point of initial stretching, in the direction of initial stretching.

The elastic laminate 70 is preferably joined to, more preferably directly secured to the respective edges 78 of the liquid impervious film (i.e., the liquid impervious film 68) through an adhesive 76 as shown in Fig. 7. In a preferred embodiment, while liquid impervious film 68 longitudinally extends in the front, back and crotch regions 26, 28 and 30, it does not laterally extend into at least one of, preferably each of the extensible ear panels 46 and 48. In a more preferred embodiment, the elastic laminate 70 is joined to the respective edges 78 of the liquid impervious film 68 at the outer-facing surface 77 as shown in Fig. 7. In an alternative embodiment, the elastic laminate 70 may be joined to the respective edges 78 of the liquid impervious film 68 at the body-facing surface 79. Preferably, the adhesive 76 is applied in a spiral glue pattern. In a preferred embodiment, the adhesive 76 is a flexible adhesive with an amorphous and crystallizing component. Such a preferred adhesive is made by Nitta Findley Co., Ltd., Osaka, Japan, under the designation H2085F. Alternatively, the elastic laminate 70 may be joined to the respective edges 78 of the liquid impervious film 68 by any other bonding means known in the art which include heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or combinations of these attachment means.

TEST METHOD

The peel strength is measured by using an electronic tensile tester which is available from Instron Cooperation (Mass., U.S.A.) under the trade name Instron 5564, with a load cell of 10~100 (N). The tensile tester has an upper jaw and a lower jaw which is located below the upper jaw. The upper jaw is movable and is connected to an extension force measuring means. The lower jaw is fixed in the tester. Before the measurement starts, a sample laminate is conditioned at about 24 °C for at least about 15 minutes. The sample laminate is then cut into a strip(s) having a width of 1.0 in. (2.54 cm) in the machine

direction (MD), and a length of 6.0 in. (15.24 cm) in the cross-machine direction (CD). From one end of the laminate strip, the elastomeric scrim is separated from the first fabric layer in a length of about 2 in. (5.08 cm). The scrim portion separated is clamped by the upper jaw of the tensile tester. The first fabric layer portion separated is clamped by the lower jaw of the tensile tester. The tensile tester is started and the upper jaw moves up at a crosshead speed of 12 in./min for a travel distance of 8 in. (the gauge length is 9 in. after the test). The load force is recorded during the travel distance (i.e., 0 to 8 in.). The peel strength (g/in.) is calculated as the average value of the load force measured during the period between the 3 in. point and the 6 in. point. The measurement is repeated 3 times for each sample laminate.

It is understood that the examples and embodiments described herein are for illustrative purpose only and that various modifications or changes will one skilled in the art without departing from the scope of the present invention.be suggested to

WHAT IS CLAIMED IS:

1. An elastic laminate elastically extensible in at least one direction, comprising:

a first fibrous layer including first component fibers; and

an elastomeric scrim including a plurality of first strands and a plurality of second strands which intersect the first strands;

wherein the first component fibers of the first fibrous layer are melted to form a fusion bond between the first fibrous layer and the elastomeric scrim, while the elastomeric scrim keeps an integrity of the first and second strands.

2. The elastic laminate of Claim 1, further comprising a second fibrous layer including second component fibers, wherein the second component fibers of the second fibrous layer are melted to form a fusion bond between the second fibrous layer and the elastomeric scrim, while the elastomeric scrim keeps an integrity of the first and second strands.

3. The elastic laminate of Claim 1, wherein the elastic laminate has a peel strength of at least about 30 gf/in. (11.8 gf/cm).

4. The elastic laminate of Claim 1, wherein the first and second strands have an average caliper reduction of at least about 5%.

5. The elastic laminate of Claim 1, wherein the first and second strands are formed by an identical material.

6. The elastic laminate of Claim 1 or 2, wherein the component fibers of the fibrous layer is selected from the group consisting of polyolefine, polyester, polyamide, and mixtures thereof.

7. A method for forming an elastic laminate, comprising the steps of:

supplying a first fibrous layer including first component fibers, the first component fibers having a first softening temperature at a first bonding pressure;

applying a heat to the first fibrous layer so that at least a portion of the first fibrous layer can have a temperature which is higher than the first softening temperature;

supplying an elastomeric scrim including a plurality of first strands and a plurality of second strands which intersect the first strands;

juxtaposing the first fibrous layer and the elastomeric scrim; and

applying a pressure of at least the first bonding pressure to the juxtaposed portion of the first fibrous layer and the elastomeric scrim so that the first component fibers of the first fibrous layer can be melted to form a fusion bond between the first fibrous layer and the elastomeric scrim, while the elastomeric scrim keeps an integrity of the first and second strands.

8. The method of Claim 7, wherein at least one of the first and second strands have a second softening temperature at the first bonding pressure, and wherein the method further comprises the step of applying a heat to the elastomeric scrim so that at least a portion of the elastomeric scrim can have a temperature which is higher than the second softening temperature.

9. An elastic laminate formed by the method of Claim 7.

10. A disposable product comprising the elastic laminate of Claim 1 or 9.

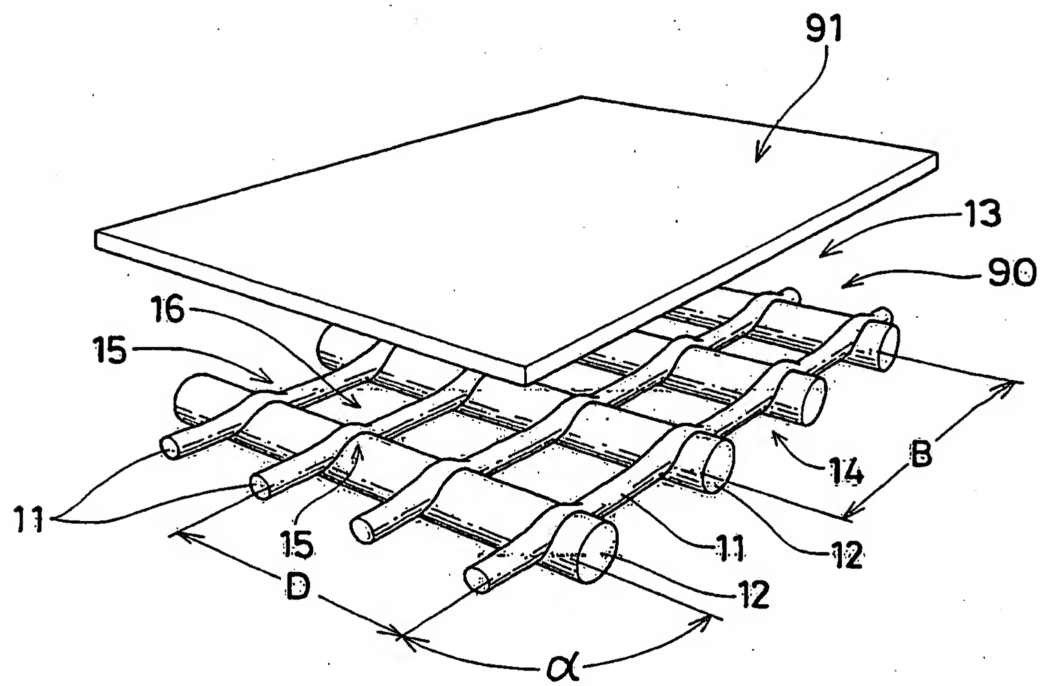

Fig. 1

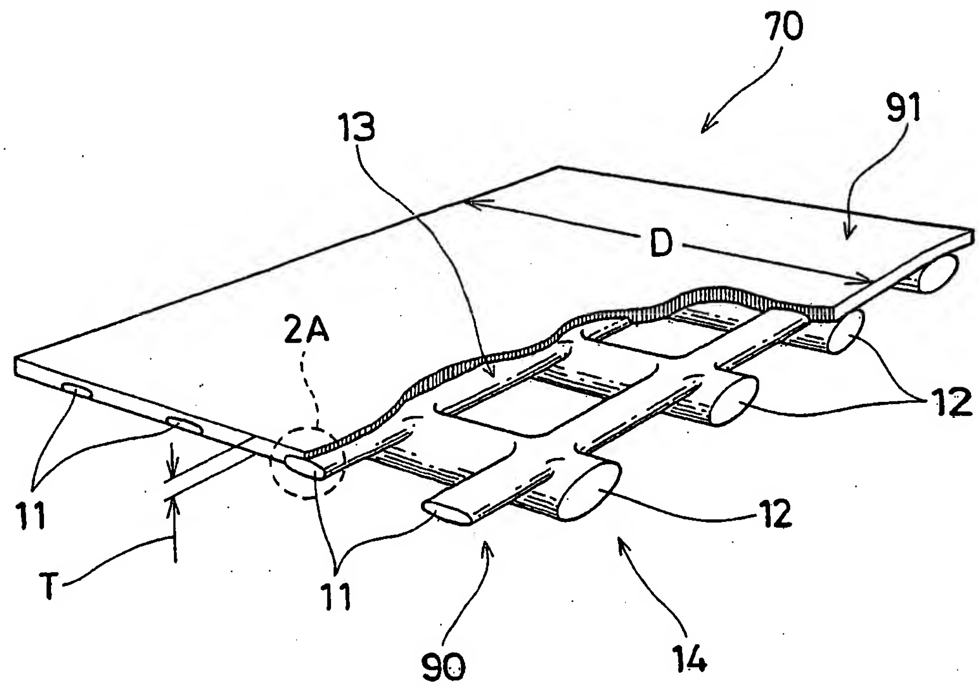

Fig. 2

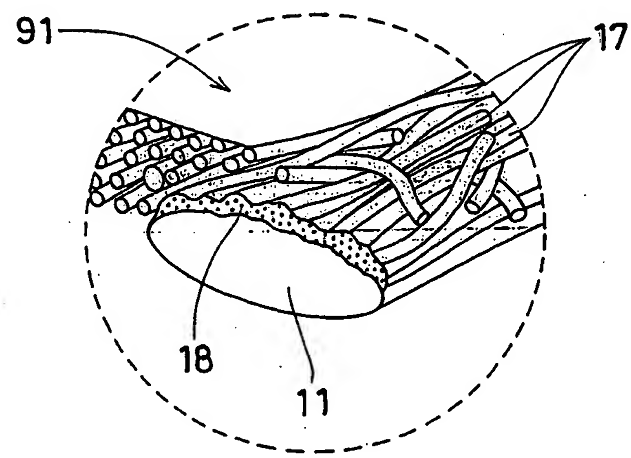

Fig. 2A

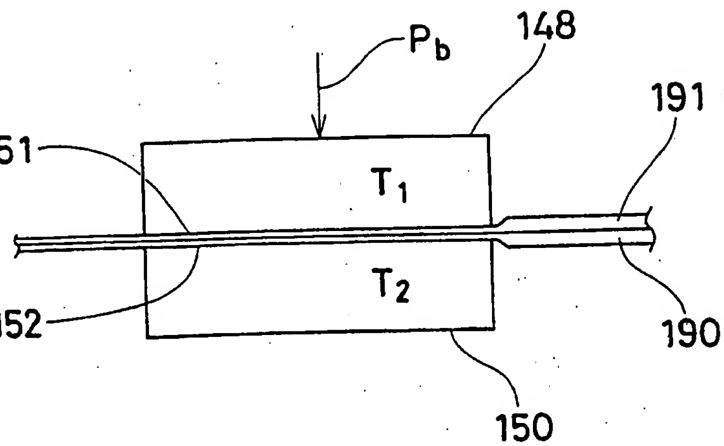
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Fig. 3

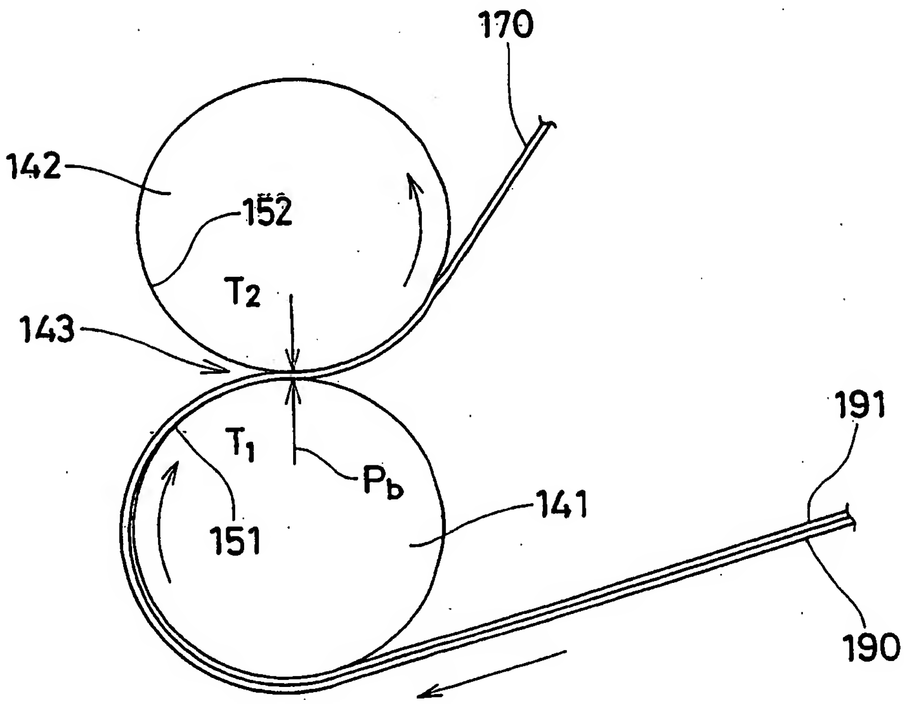
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Fig. 4

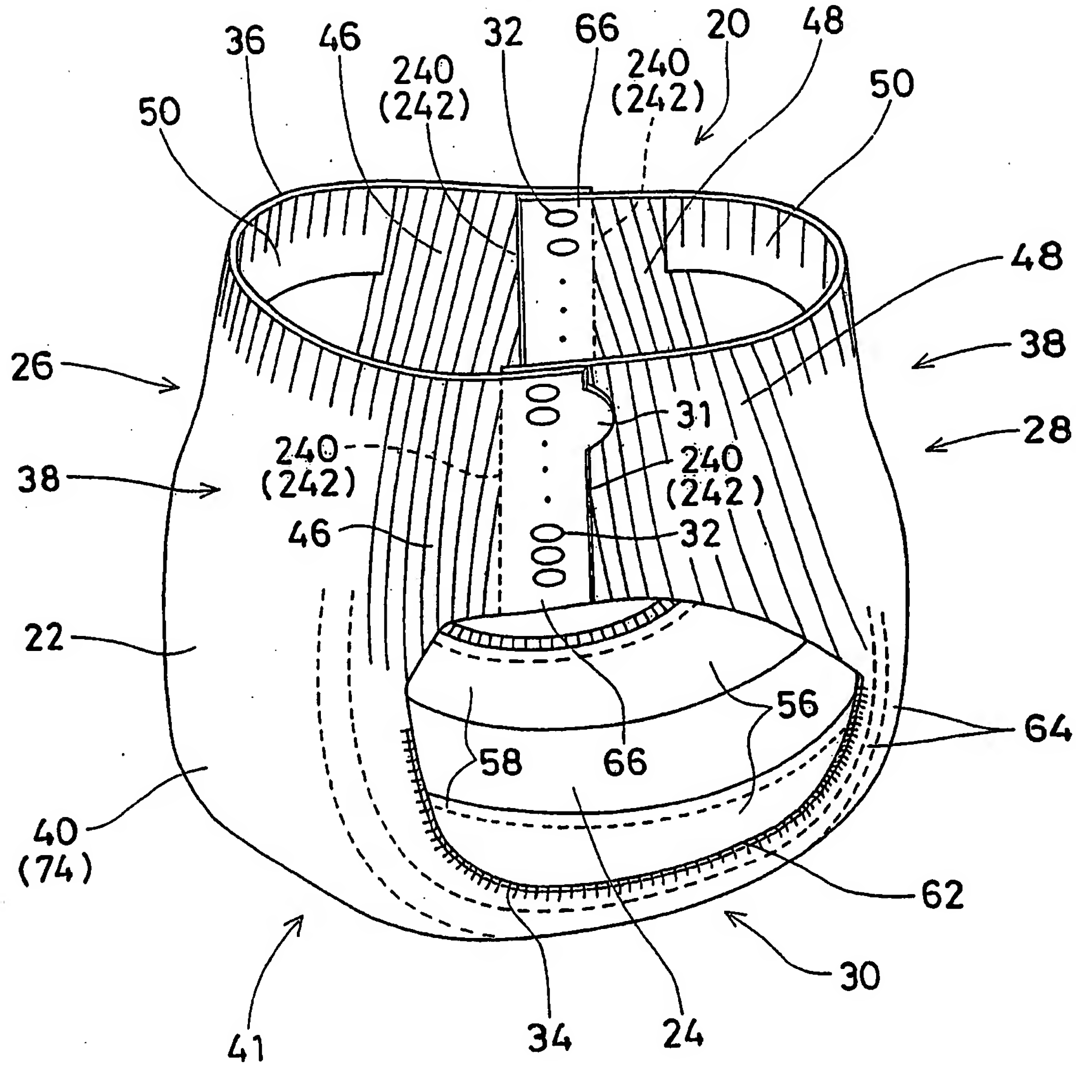
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Fig.5

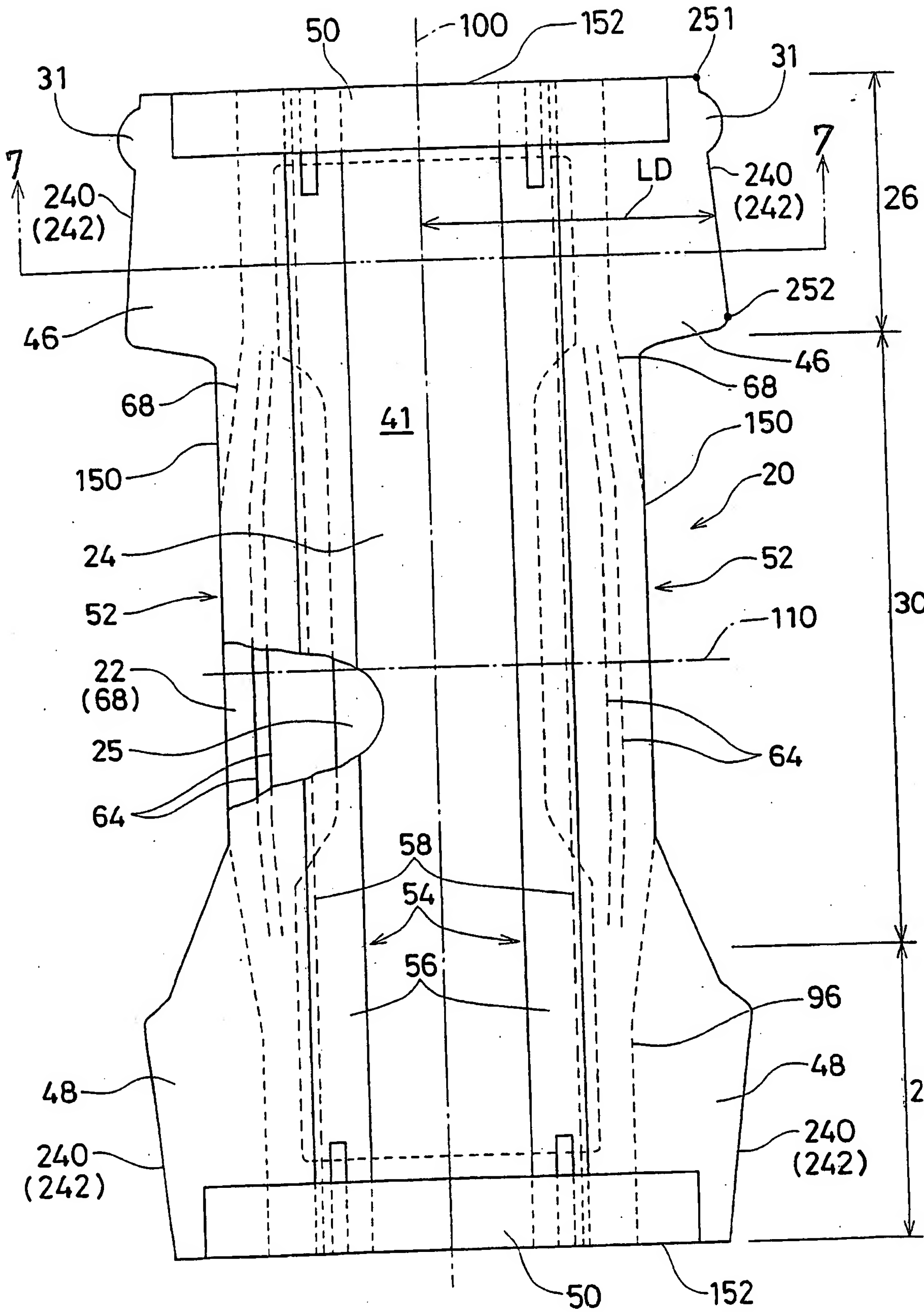
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Fig.6

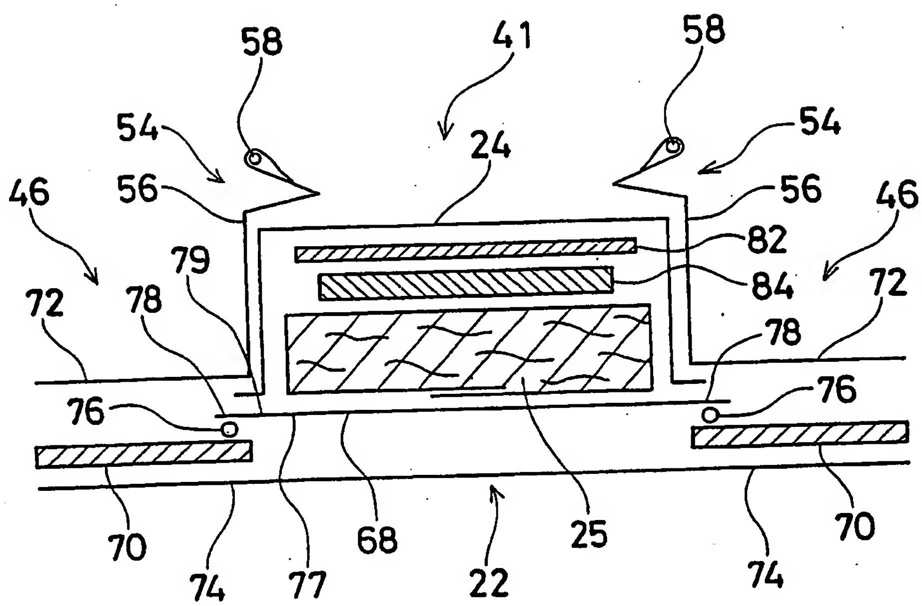
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Fig.7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/30625

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B32B5/02 B32B7/04 D04H13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 03443 A (FIBERWEB NORTH AMERICA INC ;QUANTRILLE THOMAS E (US)) 2 February 1995 (1995-02-02) page 21, line 23 -page 24, line 29; claims 1-11,55-68; figures abstract; figures 7,8	1-6,9,10
X	US 5 334 446 A (QUANTRILLE THOMAS E ET AL) 2 August 1994 (1994-08-02) column 3, line 50 -column 8, line 37; figures 3,4	1-6,9,10
A		7,8
A	WO 99 10166 A (PROCTER & GAMBLE) 4 March 1999 (1999-03-04) cited in the application claims; figures	1-10

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 August 2000	06/09/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ibarrola Torres, O

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/30625

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9503443 A	02-02-1995	US 5334446 A	02-08-1994
		AU 3482093 A	01-09-1993
		AU 3589193 A	01-09-1993
		BR 9305793 A	18-02-1997
		CA 2128731 A	05-08-1993
		CA 2128732 A	05-08-1993
		EP 0621910 A	02-11-1994
		EP 0621911 A	02-11-1994
		JP 7503291 T	06-04-1995
		JP 7503292 T	06-04-1995
		MX 9300386 A	01-08-1993
		WO 9315247 A	05-08-1993
		WO 9315248 A	05-08-1993
		US 5393599 A	28-02-1995
		US 5431991 A	11-07-1995
US 5334446 A	02-08-1994	AU 3482093 A	01-09-1993
		AU 3589193 A	01-09-1993
		BR 9305793 A	18-02-1997
		CA 2128731 A	05-08-1993
		CA 2128732 A	05-08-1993
		EP 0621910 A	02-11-1994
		EP 0621911 A	02-11-1994
		JP 7503291 T	06-04-1995
		JP 7503292 T	06-04-1995
		MX 9300386 A	01-08-1993
		WO 9315247 A	05-08-1993
		WO 9315248 A	05-08-1993
		WO 9503443 A	02-02-1995
		US 5393599 A	28-02-1995
		US 5431991 A	11-07-1995
WO 9910166 A	04-03-1999	US 6090234 A	18-07-2000
		AU 8353598 A	16-03-1999
		EP 1005417 A	07-06-2000
		NO 20000844 A	13-04-2000